We claim:-

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1. A monopulse radar tracking system, including either or both of a doppler tracking loop and an angle tracking loop, means for deriving from a target echo an intermediate frequency(I.F.) signal, means for estimating an I.F. target signal frequency periodically, digital filter means providing a frequency analysis of signals in the I.F. band, the characteristic of said filter means comprising a plurality of similar, sequential, overlapping, peaking characteristics, defining respective adjoining frequency bins, and means for producing from target signals output in adjacent frequency bins in the vicinity of the estimated target signal frequency a derived signal characteristic having a peak at a predetermined position in relation to said estimated target signal frequency, means for correcting the estimate of target signal frequency and shifting said derived signal characteristic accordingly, the target signal resulting from said derived signal characteristic being employed in a said tracking loop.

2. A radar tracking system according to Claim 1, including a doppler tracking loop having a speedgate filter in the I.F. signal path, wherein said derived signal characteristic has sections centred symmetrically above and below the estimated target signal frequency, and means are provided for comparing target signal constitutents of the respective sections and thereby determining the frequency error between the actual and estimated target signal frequency, said frequency error being employed to control the I.F. target frequency to tend to maintain it at a predetermined frequency within the passband of said speedgate filter and to tend to bring said derived characteristic into alignment with

the actual target signal frequency.

3. A radar tracking system according to Claim 2, wherein said derived characteristic comprises two, overlapping, peaking characteristics similar to the individual characteristics of said digital filter means, the two bin characteristics thus derived having peaks displaced on opposite sides of the estimated target signal frequency by half of a frequency bin width.

4. A radar tracking system according to Claim 3, wherein said means for comparing target signal constituents of the respective sections comprises means responsive to the power outputs within the two derived bin characteristics and means for obtaining an algebraic difference of the power outputs to indicate the degree and direction of the frequency error.

a ~~5~~ 3 2 A radar tracking system according to Claim ~~2~~ 1, wherein said frequency error is added to the estimated target frequency to provide a controlling signal tending to maintain the I.F. target signal in the centre of the speedgate pass band.

a ~~6~~. 4 A radar tracking system according to Claim ~~2~~ 1, wherein said digital filter means comprises an array of fast fourier transform filters each providing one said frequency bin, the output data being up-dated periodically and at each such up-date providing a new estimate of the target signal frequency derived from the preceding estimate and the current error.

a a ~~7~~ 8. A ~~missile-borne~~ radar tracking system in a missile according to Claim ~~2~~ 1, including means responsive to high acceleration rates of the missile to increase the width of said frequency bins and thus improve the quality of tracking at the expense of target discrimination. 8

~~8~~ 9. A radar tracking system according to Claim 7

wherein said doppler tracking loop incorporates controllable gain elements which are set to high gain values in response to high acceleration rates.

~~9.~~ 5 A ~~missile-borne~~ radar tracking system according to Claim ~~2~~ 1, 2 or 7 is a missile, wherein the width of said frequency bins is controllable in dependence upon target range, the bin width being set to a low value in response to a long range target to optimise the acquisition threshold.

~~10.~~ 6. A radar tracking system according to Claim ~~9~~ 5, wherein said doppler tracking loop incorporates controllable gain elements which are set to low gain values in response to a long range target.

~~11.~~ 7. A missile-borne radar tracking system according to Claim ~~2~~ 1, 2 or 7 is a missile, wherein the width of said frequency bins is controllable in dependence upon the estimated value of the difference between the target signal frequency and said predetermined frequency within the speedgate pass band, the bin width being increased in response to a high estimated value to give good tracking ability and decreased in response to a low estimated value to give good velocity discrimination against targets moving at low relative velocities.

~~12.~~ 10 A radar tracking system according to Claim 1 including an angle tracking loop employing sum and difference channels and means responsive to a ratio of the sum and difference signals to provide an indication of angular error between target line of sight and boresight, wherein each of said sum and difference channels employs means for producing a said derived signal characteristic, each such derived signal characteristic comprising a peaking characteristic similar to the individual characteristics of said digital filter means and centred on the estimated target signal frequency so as to provide a narrow frequency pass band which tracks the estimated target signal frequency.

~~13~~ 11. In a monopulse radar tracking system employing sum and difference signals for the determination of target direction, the system comprising a doppler tracking loop maintaining an intermediate frequency target signal within a speedgate filter pass band, and digital filter means in each of the sum and difference channels providing at periodic update intervals an analysis over a plurality of adjacent frequency bins of target signal components within the said pass band, a method of confirming the presence or absence of a target signal within a particular frequency bin, in which a series of comparison processes are performed, each involving the sum of a predetermined number of successive power output values from the particular frequency bin accumulated with any previous such sums and a comparison of such cumulative sum with upper and lower threshold values which become progressively closer with each comparison process, confirmation of the presence of a target signal in any comparison process being indicated when the upper threshold is exceeded by said cumulative sum, confirmation of the absence of a target signal being indicated when the lower threshold exceeds the cumulative sum, and a further comparison process being initiated when the cumulative sum lies between the upper and lower thresholds.

~~14~~ 12. A method according to that of Claim ~~13~~ 11 wherein after a said series of a predetermined number of said comparison processes the upper and lower thresholds are made coincident so as to force a target-signal-present, or absent, indication.

~~15~~ 13. A method according to Claim ~~13~~ 11, wherein a running average is established incorporating a fixed number of said bin power output values, the earliest incorporated bin power output value being discarded as a

current value is incorporated so as to produce a running average bin power, this running average being compared with a predetermined threshold to provide a target-signal-present, or absent, indication, the cumulative sum indication and the running average indication contributing to a net conclusion in which the cumulative sum indication takes precedence if the running average indication points to a target signal absent, and in which the possible results of the cumulative sum indication: target signal absent, indeterminate, present, are treated as: indeterminate, present, present, respectively if the running average indication points to a target signal present.

14. A radar tracking system employing sum and difference signals for the determination of target direction, the system including digital filter means in each of the sum and difference channels providing at periodic update intervals an analysis over a plurality of adjacent frequency bins of potential target signal components, means for identifying a target frequency bin, means for applying sum and difference signals in respect of the identified target frequency bin as input signals to product means for producing a complex product of one of said input signals and the complex conjugate of the other, a signal-to-noise ratio indication being derived from the imaginary component of said complex product and a power level indication of the sum channel signal within the target frequency bin, said signal-to-noise ratio indication thus having a high value in the presence of incoherent reflections from multiple targets and a low value in the presence of coherent reflections from a single target, the system further including a basic signal-to-noise ratio indication derived from power level within the target frequency bin and average power level over the plurality of frequency bins, this basic indication thus having a high value in the presence of single or multiple targets within the target frequency bin and a low value in the presence of wideband noise,

and means responsive to both of said signal-to-noise ratio indications to provide an indication of single or multiple targets.

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